

NEW SPECIES, SUBSPECIES AND RECORDS OF *DELIAS* HÜBNER (LEPIDOPTERA: PIERIDAE) FROM THE UPPER OK TEDI AND TARI REGIONS, PAPUA NEW GUINEA

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Abstract

Three new species and six subspecies of *Delias* Hübner from Papua New Guinea are described and illustrated: *Delias felis* sp. nov., *D. inopinata* sp. nov., *D. binniensis* sp. nov., *D. mira pellos* subsp. nov., *D. carstenziana starensis* subsp. nov., *D. awongkor hindenburgensis* subsp. nov., *D. iltis bultemensis* subsp. nov., *D. fascelis cartieri* subsp. nov. and *D. luctuosa versicolor* subsp. nov. Notes on distribution are presented for 35 further species in the Ok Tedi and Tari areas, including the following newly recorded from Papua New Guinea: *D. pheres* Jordan, *D. oktanglap oktanglap* van Mastrigt, *D. frater* Jordan, *D. catisa catisa* Jordan, *D. alepa alepa* Jordan, *D. leucias leucias* Jordan, *D. wollastoni abmisibilensis* van Mastrigt, *D. hypomelas conversa* Jordan.

Introduction

In recent years considerable work has been done on *Delias* Hübner in Irian Jaya, with many new species and subspecies described from previously underresearched areas. By contrast, little has been published in recent years on *Delias* in Papua New Guinea. The majority of species described and their distribution records relate to the central and eastern parts of the country. Parsons (1998) provided the most recent comprehensive list of species recorded and their distributions but there is no mention of the Ok Tedi area. An extensive survey was carried out, primarily in the upper Ok Tedi region, between February 1991 and January 2000. This resulted in many new geographic records and the collection of several undescribed species and subspecies. These new species and subspecies are described in this paper and numerous other distribution records presented. Terminology of wing venation and regions is based upon Parsons (1998).

Specimen depositories are abbreviated as follows: AMS — Australian Museum, Sydney; ANIC — Australian National Insect Collection, CSIRO, Canberra; RBLC — R. B. Lachlan Collection.

Delias felis sp. nov.

(Figs 1–6)

Types. PAPUA NEW GUINEA: *Holotype* ♂, Mount Binnie, 2200m, next to Ok Tedi mine, Western Province, 5°13'S 141°08'E, 22.v.1993, R.B. Lachlan. *Paratypes*: 2 ♂♂, 2 ♀♀, SE slopes of Mt Akrik (Ian), 15km NW of Tabubil, Western Province, 5°10'S 141°09'E, 1625m, 21.ix.1992, 26.ix.1993, 20.xi.1993, 1.iv.1994, R.B. Lachlan. *Holotype* in ANIC; *paratypes* in RBLC.

Description. Male (Figs 1–4). Fore wing upperside with basal half white with faint blue tinge to just short of distal end of discal cell (black underside giving faint blue colour); black costal border entering

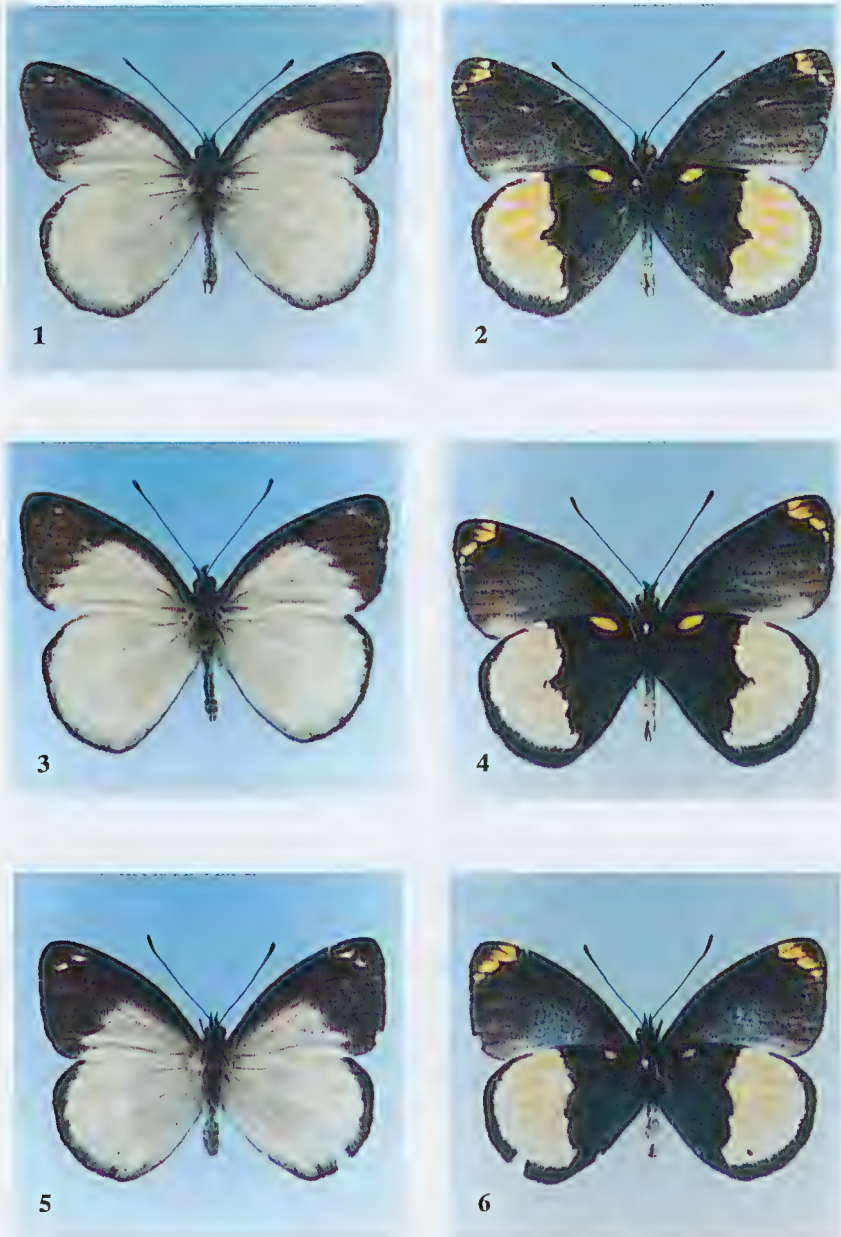
anterior half of discal cell; one vague subapical spot; distal half of fore wing black with tornus curving basally. Hind wing upperside white; narrow black border from apex to tornus suffused with white. Fore wing underside nearly all black with three yellow-orange subapical spots; one specimen (Fig. 4) with one or two very small, thin yellow-orange terminal spots; a small amount of white diffused with black below vein CuA_2 at subtornal and ternal area; mostly white below vein $1A+2A$. Hind wing underside with basal half black with distinct subbasal yellow-orange spot near costa; distal half white overlaid with yellow-orange scales to varying degrees (Figs 2, 4) becoming white at outer edge at black border; veins white; black border thin at apex, widest at tornus (2–3 mm); separation between black and yellow-orange irregular and variable from middle of costal margin to tornus passing slightly through distal edge of cell. Length of fore wing: 26–29 mm.

Female (Figs 5–6). Fore wing upperside as in male but with reduced white area; between one third and two thirds of anterior portion of discal cell black; one or two pale yellow subapical spots much less distinct than those on the underside. Hind wing upperside as in male with slightly broader black terminal border. Underside of both wings as in male; subbasal yellow-orange spot near costa reduced and faint. Length of fore wing: 27 mm.

Etymology. The specific name is derived from '*felis*', Latin for cat, and pertains to the black markings on the hind wings and the yellow-orange subbasal spots giving the appearance of a black cat's face.

Discussion. Although *D. felis* closely resembles *D. hemianops* Gerrits & van Mastrigt and, to a lesser extent, *D. fioretti* van Mastrigt, it differs by having a yellow-orange subbasal spot on the hind wing underside, absent entirely in *D. hemianops* and *D. fioretti*. The underside of the fore wing of *D. felis* has a reduced white subtornal and ternal area diffused with black. *D. hemianops* has a larger, more intense white area in the same region. The distal orange area on the underside of the hind wing of *D. hemianops* and *D. fioretti* is completely orange with white veins. In *D. felis* this area is white overlaid with yellow-orange scales, giving a much paler overall appearance with some specimens showing little yellow-orange at all. The separation line between the black and orange areas on the underside of the hind wing in both *D. hemianops* and *D. fioretti* is more or less straight; in *D. felis* it is irregular and variable. The female of *D. felis* has only one or two subapical spots on the fore wing upperside, that of *D. hemianops* has four orange subapical spots as noted in the original description (Gerrits and van Mastrigt 1992).

Despite intensive collecting at many sites, only five specimens of *D. felis* were collected at two sites, 4 km apart, between February 1991 and January 2000. The characters of *D. felis* place it in the *clathrata* group within the genus *Delias*.



Figs 1–6. *Delias felis* sp. nov. (1) holotype male upperside; (2) holotype male underside; (3) male upperside; (4) male underside; (5) female upperside; (6) female underside.

Delias inopinata sp. nov.

(Figs 7–8, 13–14)

Types. PAPUA NEW GUINEA: *Holotype* ♂, SE slopes of Mt Akrik (Ian), 15 km NW of Tabubil, Western Province, 5°10'S 141°09'E, 1625 m, 14.iii.1994, R.B. Lachlan. *Paratypes*: 20 ♂♂, same locality, 1–2.iv.1991, 18.v.1991, 8, 23.x.1993, 15, 19–20.iii.1994, 8, 10.iv.1994, R.B. Lachlan, 21–22.xi.1996, M.S. Moulds; 1 ♂, 16 km NE of Tabubil, Western Province, 5°10'S 141°20'E, 2200 m, 18.i.2000, R.B. Lachlan. *Holotype* in ANIC; *paratypes* in RBLC.

Description. Male (Figs 7–8). Fore wing upperside white to just beyond end of discal cell, apical and marginal areas black tapering to 2 mm at tornus; two faint subapical spots in half the specimens examined. Hind wing upperside white, partly translucent with underside pattern visible; a black border widest at apex, broken into spots towards tornus, inner edge scalloped, the width of this border variable, 2–4 mm at apex; faintly yellow along anal margin. Fore wing underside with broad black costal margin; discal cell nearly entirely black (Fig. 8) or black with small area at posterior edge towards end of cell diffused with cream scales; black scaling extends beneath cell at base; creamy-white patch lightly diffused with black scaling, sometimes heavily but not as much as in *D. endela* Jordan; three subapical and three, or sometimes two, small marginal spots, the last spot often very faint, the second subapical spot usually longer and positioned basally of the first spot (Fig. 8). Hind wing underside very dark brown with light yellow suffusion distal of median crenulate band and anal veins area; one humeral, three subbasal and six submarginal yellow spots; ternal spot often split into two small parallel spots; median yellow and cream crenulate band from costal margin to just below vein CuA₂, becoming broken yellow to dorsum near tornus, narrower than in *D. aroae* (Ribbe) and *D. pheres* Jordan, very narrow in part between veins R5 and M1; yellow and cream spike-like protrusions along the wing veins on the distal edge of crenulate band reduced in majority of specimens. Length of fore wing: 24–26 mm, in two specimens 21 mm.

Genitalia. (Figs 13–14). Distal edge of valve (Fig. 14) with two finger-like processes and a deep proximal excavation, the distal process longer; these are slightly variable in shape; dorsal edge slightly incurved; ventral fold strongly developed. Uncus (Fig. 13) with middle lobe short and broad, narrowed at apex; lobe on each side small and directed outward; lateral margin of uncus concave; tegumen incurved anteriorly, broadened posteriorly.

Female. Unknown.

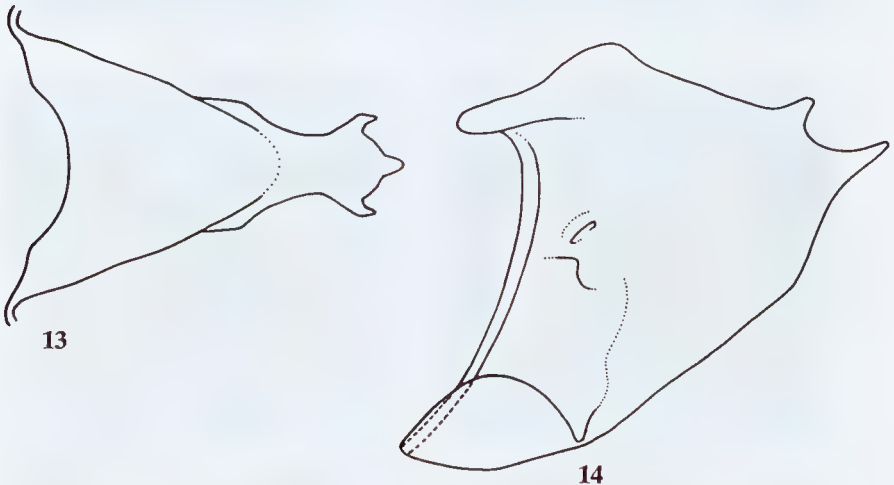
Etymology. The specific name '*inopinata*' is derived from the Latin, meaning surprise; it came as a surprise to find a third species similar to *D. aroae* and *D. pheres* all flying together.

Discussion. Although *D. inopinata* (Figs 7–8) closely resembles *D. aroae* (Fig. 9) and *D. pheres* (Fig. 10), with which it flies at both known localities.



Figs 7-12. (7-8) *Delias inopinata* sp. nov. (7) holotype male upperside; (8) holotype male underside. (9) *Delias aroae* (Ribbe), male underside. (10) *Delias pheres* Jordan, male underside. (11-12) *Delias binniensis* sp. nov. (11) holotype male upperside; (12) holotype male underside.

for *D. inopinata*, there are a number of external characters that clearly distinguish it as a distinct species. By comparison, *D. inopinata* is darker overall on the underside; in *D. aroae* and *D. pheres* the hind wing underside submarginal spots are generally slightly larger; the width of the yellow and white median crenulate band is narrower and does not reach the dorsum, and the spike-like protrusions along the wing veins on the distal edge of this band are generally reduced. On the fore wing underside the black basal suffusion below the cell is very evident in *D. inopinata* but rarely seen, and then only to a small extent, in either *D. aroae* or *D. pheres*; the cream patch is always suffused with some black scaling; the second subapical spot is almost always positioned basal to the first spot, unlike the same two spots in *D. aroae* and *D. pheres*, which are positioned and shaped differently in almost all specimens taken in the upper Ok Tedi region (see Figs 8–10); this character alone enabled separation of all three species following examination of the 35 *D. aroae*, 81 *D. pheres* and 22 *D. inopinata* specimens collected from all localities. The hind wing uppersides of all three species are very similar given the slight variation in the black borders within each species; however, whereas *D. inopinata* has faint yellow along the anal margin, the other two species do not. On the fore wing upperside of *D. inopinata* the basal white area extends slightly beyond the cell as in *D. aroae*, but the separation line between the black and white tends to be slightly less curved apically in most specimens of *D. inopinata*; in *D. pheres* the white area does not reach the end of the discal cell.



Figs 13–14. Male genitalia of *Delias inopinata* sp. nov. (13) uncus in dorsal view; (14) right valve in lateral view.

The genitalia of several specimens was examined and showed slight variation in the size of the two finger-like processes on the distal edge of the valve and the size and shape of the lobes on the uncus. The valve in overall appearance is similar to *D. aroae* which also shows variation. The uncus is also similar to *D. aroae* but not as concave on the lateral margin and the tegumen is more strongly incurved anteriorly than seen in many specimens of *D. aroae*.

In overall appearance, *D. inopinata* should be placed in the *aroae* species-complex as defined by Orr and Sibatani (1986). It is surprising to note that, despite intensive collecting at many different sites between 800 and 3200 m from 1991 to January 2000, 21 specimens were taken on Mt Akrik at 1625 m and only one specimen was collected at a site 20 km to the east at 2200 m.

Delias binniensis sp. nov.

(Figs 11–12, 15–16)

Types. PAPUA NEW GUINEA: *Holotype* ♂, Mount Binnie, 2200 m, next to Ok Tedi mine, Western Province, 5°13'S 141°08'E, 8.v.1993, R.B. Lachlan. *Paratype*: 1 ♀, same locality, 21.i.2000, R.B. Lachlan. *Holotype* in ANIC; *paratype* in RBLC.

Description. Male (Figs 11–12). Fore wing upperside deep citron yellow; narrow black costal margin, black distally from postmedian area to apex; black terminal border narrowest at tornus and curved slightly along inner margin basally; separation line between yellow area and black outer margin straight and angled towards tornus; yellow between veins 1A+2A and CuA₂ curved distally; black scales cover the two discocellular veins and veins M₂ and M₃ in yellow area. Hind wing upperside almost entirely deep citron yellow; thin black terminal border at apex only; small black spots at terminal edge of veins CuA₂, CuA₁ and M₃. Fore wing underside yellow just below discal cell to inner margin and tornus below vein CuA₂; some yellow suffusion with black in distal area of discal cell near posterior edge of cell; black basally of discocellulars; transverse yellow band 2 mm in width from just below costa to vein M₂ narrowing inwardly to vein M₃ where it joins main yellow area; four small subapical spots and two very small faint terminal spots, all yellow. Hind wing underside basally dark brown tinged with yellow, strongly so at anal margin; narrow median crenulate band yellow-orange and white tending yellow-orange only at white anal veins; six thin yellow-orange submarginal spots similar to those of *D. konokono* Orr & Sibatani, except ternal spot rounder; broad marginal band yellow-brown; three distinct yellow-orange spots close together at wing base just below costa and inside discal cell. Termen slightly scalloped. Length of fore wing: 26 mm. Abdomen above light yellow laterally; white beneath.

Female (Figs 15–16). Fore wing upperside deep citron yellow as in male; broad black costal border entering anterior third and distal end of discal cell; one flattened yellow costal spot above discocellulars; faint yellow patch below spot; two small subapical yellow spots; black distal margin slightly broader than in male. Hind wing upperside yellow as in male but



15



16



17



18



19



20

Figs 15–20. (15–16) *Delias binniensis* sp. nov. (15) female upperside; (16) female underside. (17–20) *Delias mira pellos* subsp. nov. (17) male upperside; (18) male underside; (19) female upperside; (20) female underside.

with broader black terminal border, widest at apex; black border broken by yellow spots at and above tornal area. Fore wing underside as in male but with larger yellow area in distal part of discal cell. Hind wing underside as in male but median crenulate band slightly wider and whiter.

Etymology. *D. binniensis* is named after Mount Binnie, the only known locality for the species.

Discussion. *D. binniensis* clearly belongs to the *aroae-cuningputi* group. However, its exact placement is difficult as it is unique in having characters from both groups. The slightly scalloped hind wing border and the underside yellow-orange spots reduced to a thin bar or spot parallel to the termen, with thin lines radiating from their midpoints usually reaching the termen, are characters pertaining to the *cuningputi* group of Orr and Sibatani (1986).

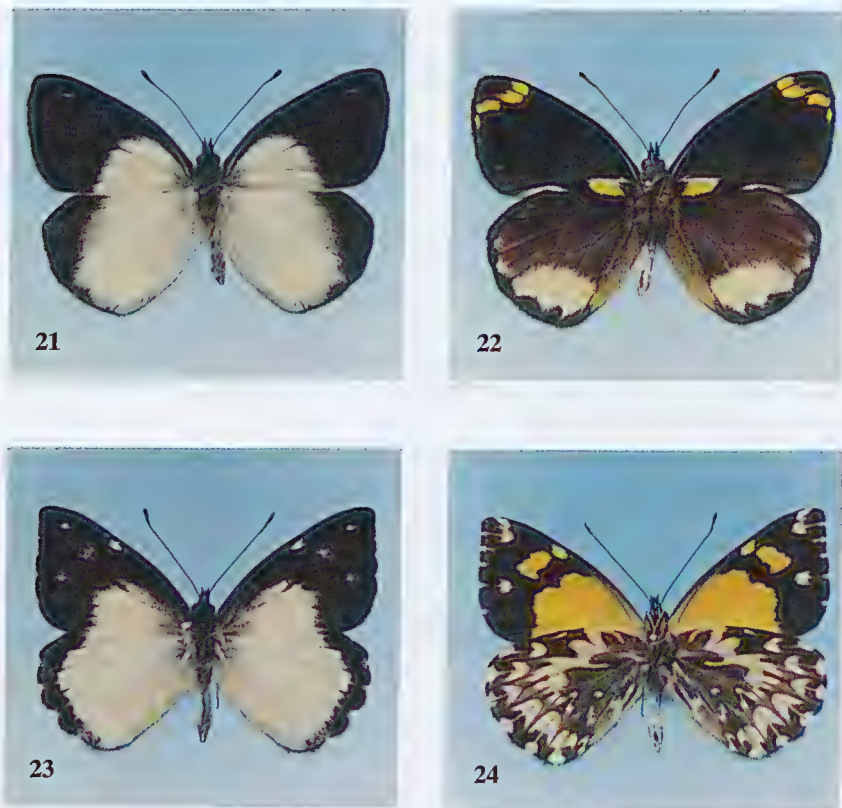
The thin, black, broken terminal border on the hind wing upperside of the male *D. binniensis* closely resembles those of *D. aroae* and *D. pheres* from the *aroae* group. Other underside markings seen in both the male and female of *D. binniensis* are more typical of most species in the *arbae* group and as such *D. binniensis* is tentatively placed in the *aroae* group, pending the availability of additional male specimens for genitalic assessment. However, Orr and Sibatani (1985) found male genitalia to be variable and of minimal use at species level, especially in the study of closely related species. The only other yellow species recorded are *D. citrona* Joicey & Talbot from the *cuningputi* group and *D. flavissima* Orr & Sibatani from the *aroae* group. *D. binniensis* is distinctly different from both these species by way of the yellow colour and wing pattern. The very distinct straight separation line between the yellow and black on the male fore wing upperside is not seen on any other species in the *aroae-cuningputi* group. It may be better to regard *D. binniensis* as a species linking the two groups.

***Delias mira pellos* subsp. nov.**

(Figs 17–22)

Types. PAPUA NEW GUINEA: *Holotype* ♂, SE slopes of Mt Akrik (Ian), 15 km NW of Tabubil, Western Province, 5°10'S 141°09'E, 1625 m, 1.iv.1991, R.B. Lachlan. *Paratypes:* 15 ♂♂, same locality, 1.iv.1991, 18.v.1991, 23.x.1993, 28.xi.1993, 15.iii.1994, 3, 10–11.iv.1994; 1 ♀, Mt Binnie, 2200 m, behind Ok Tedi mine, Western Province, 5°13'S 141°08'E, 15.i.2000, R.B. Lachlan. *Holotype* in ANIC; *paratypes* in AMS and RBLC.

Description. Male (Figs 17–18, 21–22) Forewing upperside as in Figs 17, 21; basal third white with black costa; distal two thirds black; 1–3 very small faint subapical spots; inner edge of black border mainly straight from discal cell to inner margin; posterior half of cell white but not reaching discocellulars; posterior cell vein blackish in most specimens; light grey



Figs 21–24. *Delias mira pellos* subsp. nov. (21) holotype male upperside; (22) holotype male underside. (23–24) *Delias carstensziana starensis* subsp. nov. (23) holotype male upperside; (24) holotype male underside.

suffusion at wing base and outer edge of white area. Hind wing upperside mostly white with underside pattern partly visible; black border widest at vein M_1 at 5–6 mm, narrowest at tornus but variable (Figs 17, 21). Fore wing underside as in Figs 18, 22; black with some white scaling on basal third of costal vein; white below vein $1A+2A$ to inner margin; three subapical spots and one smaller terminal spot, often a second faint terminal spot, all dark yellow. Hind wing underside very dark brown; sometimes a black spot in cell M_2 and more often black spots at inner edge of cream area, this spotting variable and in many specimens these dark spots are absent; cream area at distal end of cells $1A+2A$, CuA_2 and CuA_1 , often reduced in space CuA_1 , inner edge of cream suffused with dark brown when black spots are absent; black border undulate to triangulate, faint white scaling at inner edge of black border in cell M_3 , less scaling in cell M_2 ; black basal and costal area

encloses a small slightly elongated yellow spot pointed basally and distally, small thin white line above at costa; small white spot midway along costa; anal area with yellow and black suffusion. Length of fore wing: 26–28 mm.

Female (Figs 19–20). Fore wing upperside with pale blueish-white area slightly less than in male; outer edge of white suffused with black and curved slightly basad between cell and inner margin; four small white subapical spots. Hind wing upperside with broader black border than in male; yellowish at base near costa and along anal fold. Fore wing underside with three larger subapical spots and one terminal spot, all yellow; slight white suffusion above vein 1A+2A, white below. Underside as in male. Length of fore wing: 28mm.

Etymology. The subspecific name '*pellos*' is derived from the Greek, meaning dusky, as this subspecies has a very dark overall appearance.

Discussion. *D. m. pellos* differs from the nominate subspecies by the hind wing underside with its very dark brown ground colour, almost total absence of spotting at the distal end of cell, broader black terminal border and reduced yellow basal spot. On the fore wing underside the third subapical spot is generally closer to the top two spots; in *D. m. mira* Rothschild & Jordan it is generally positioned closer to the termen. There is no small white costal spot on the underside of *D. m. pellos* as found in *D. m. mira* and all other subspecies described from Papua New Guinea. This particular character was present on eight of the ten described subspecies from Irian Jaya and Papua New Guinea. *D. m. cieko* Arima and *D. m. reissingeri* van Mastrigt, both from Irian Jaya and very similar, also lack this costal spot and both closely resemble *D. m. pellos*. However, *D. m. pellos* differs from *D. m. cieko* by having a smaller cream band and reduced yellow basal spot on the underside of the hind wing. There also appears to be white veins on the dark brown ground colour in the photograph of the holotype of *D. m. cieko*; these are absent in *D. m. pellos*. *D. m. cieko* is recorded by Arima (1996) from Waniak, E. Wamena, Irian Jaya, a distance over 250 km west of the type locality for *D. m. pellos*. *D. m. pellos* also differs from *D. m. reissingeri* by the reduced yellow basal spot on the hind wing underside and the yellow subapical spots. These are described by van Mastrigt (1996) as yellow-orange on *D. m. reissingeri*, although the photographs of the male and female types show these as clearly orange. The female *D. m. pellos* differs from *D. m. reissingeri* by the narrower black border on the hind wing upperside, the clearly reduced yellow basal spot and slightly narrower black marginal border of the hind wing underside. The fore wing underside has four large yellow subapical spots whereas *D. m. reissingeri* has five large subapical spots, described as yellow by van Mastrigt (1996) but clearly orange in the accompanying photograph.

D. m. pellos shows more white suffusion above vein 1A+2A than is seen in *D. m. reissingeri*, which is found over 130 km west of the type locality for *D. m. pellos*.

The ten previously described subspecies and *D. m. pellos* fall into four groups based upon their underside patterns, coloration and location. *D. m. mira*, *D. m. reversa* Rothschild, *D. m. excelsa* Jordan and *D. m. roepkei* Sanford & Bennett are all very similar and are all recorded from the eastern side of the island in Papua New Guinea. *D. m. pellos*, *D. m. ceiko* and *D. m. reissingeri* are close to each other but lack the small white costal spot on the fore wing underside found on all the other subspecies; they are very dark, although similar to the Papua New Guinea group; all three are recorded from the central and near western areas of the island of New Guinea within 250 km of each other. The next group, consisting of *D. m. hiemalis* Roepke, *D. m. autumnalis* Roepke and *D. m. michiae* Nakano are similar but distinct from the first two groups and are recorded from western Irian Jaya. Parsons (1998) suggested that *D. m. autumnalis* should be considered a distinct species and that proposal should be expanded to include *D. m. hiemalis* and *D. m. michiae*. The last subspecies, *D. m. flabella* van Mastrigt, is so different on the underside it must surely be considered a distinct species. Yagishita *et al.* (1993) synonymised *D. m. roepkei* with *D. m. excelsa* but Parsons (1998) synonymised *D. m. excelsa* with *D. m. mira* and retained *D. m. roepkei* as a separate subspecies. It is clear that this species needs a thorough revision based on examination of large series from many different localities.

Many of the specimens of *D. m. pellos* were found with midges, probably *Forcipomyia papuensis* Lane & Cotman, attached to veins on the underside of the hind wing in the cream patches. Parsons (1998) noted that this is common in the various *D. mira* subspecies.

***Delias carstensziana starensis* subsp. nov.**

(Figs 23–24)

Types. PAPUA NEW GUINEA: *Holotype* ♂, 30 km NNW of Tabubil, West Sepik Province, 5°01'S 141°08'E, 3200m, 17.xi.1991, R.B. Lachlan. *Paratypes:* 14 ♂♂, same locality, 16-18.xi.1991, R.B. Lachlan. *Holotype* in ANIC; *paratypes* in AMS and RBLC.

Description. Male (Figs 23–24). Fore wing upperside as in Fig.23, with broad black costal margin filling basal, anterior and distal two-thirds of cell; a postmedian oblique band of three spots, costal spot white, posterior two faint, suffused black; these two spots appear larger with wear; one small subapical white spot; small area of white occupying posterior one third or less of cell; reduced white area below cell and vein CuA₁ to inner margin; base of wing black with white suffusion. Hind wing upperside white, base black with white suffusion; black border 3 mm wide from apex almost to tornus, narrower at tornus and suffused

with four small white spots at termen halfway between veins; abdominal fold light yellow. Fore wing underside as in Fig.24; basal half yellow-orange except for costal edge, orange strongest in cell; distal half black with three oblique large postmedian spots, anterior two yellow-orange, posterior spot white; two subapical spots white with orange streaks; five small terminal white spots, their inner edges streaked orange. Hind wing underside with ground colour black; basal one-third of costa white, edged with orange; a reduced, irregularly jagged white patch edged with orange runs distally and obliquely from costa to anterior area of cell, discocellulars and just below vein CuA_1 ; this jagged patch increases in size on worn specimens; two orange spots below cell and two orange lines from base to tornus along abdominal fold; small, faint, white lines below the two orange spots reduced to very faint lines on most specimens; submarginal band of six large, bell-shaped white spots; seven small terminal spots between veins, tornal two light yellow-white, remainder white; orange streaks from inner edge of submarginal spots to terminal spots. Length of fore wing: 26–29 mm.

Female. Unknown.

Etymology. *D. carstensziana starensis* is named after the Star Mountains, the only known locality for the subspecies.

Discussion. *D. carstensziana starensis* differs from the nominate subspecies by the two large anterior spots in the oblique postmedian band of three spots on the fore wing underside being yellow-orange rather than white or white with a small degree of yellow-orange. In the original description of *D. carstensziana* Rothschild (1915), these three spots are described as 'a postmedian strongly oblique band of 3 large spots yellow'. The colour plate shown in Talbot (1928–37, pl. LV), who repeats the original description, clearly shows all three spots white with the middle spot showing a little orange at the anterior basal edge. Photographs of this species in Yagishita *et al.* (1993), D'Abrera (1978) and Parsons (1998) show this oblique band of spots clearly all white. The yellow-orange basal half of the underside of the fore wing of *D. c. starensis* differs from the yellow shown in Yagishita *et al.* (1993) and Parsons (1998) and is not the bright orange shown in Talbot (1928–37) and D'Abrera (1978). On the underside of the hind wing the white irregular jagged patch is thinner and the thin white lines beneath the two orange spots under the cell are reduced or very faint; the seven terminal spots are white, not yellow as in the original description of the nominate subspecies. On the fore wing upperside there is distinctly less white in the cell (Fig. 23) and the white patch below the cell is reduced compared to the nominate subspecies. The hind wing upperside black border is narrower than that of the specimens from Irian Jaya shown in Talbot (1928–37) and Yagishita *et al.* (1993) but similar in width to the specimen figured in Parsons (1998), which is presumably from eastern Papua New Guinea.

A single male *D. c. carstensziana* from the PNG National Collection, Port Moresby, also displays all the characters of the nominate subspecies. In the original description of the upperside, Rothschild (1915) stated that there were 'white spots on termen at end of veins on both wings', on the fore wing underside 'the terminal white spots run inwards along the veins' and on the hind wing underside 'veins beyond cell orange'. The terminal spots on both wings are actually between the veins as are the orange lines distal of the hind wing underside cell. Under a microscope raised lines are visible in the cell spaces on both wings, giving the impression of veins.

According to Roepke (1955), Toxopeus (in manuscript) believed the altitude range of *D. c. carstensziana* to be unusually large, being between 2135 and 4117 m. Despite intensive collecting at several sites between 800 and 3200 m over many years, I only ever recorded *D. c. starensis* at 3200 m, at the type locality in the southern Star Mountains.

***Delias awongkor hindenburgensis* subsp. nov**

(Figs 25–28)

Types. PAPUA NEW GUINEA: *Holotype* ♂, 16 km NE of Tabubil, 5°10'S 141°20'E, 2300 m, 30.iii.1994, R.B. Lachlan. *Paratypes:* 3 ♂♂, same locality, 27.iii.1992, 27.iii.1994, 18.i.2000, R.B. Lachlan; 1 ♀, same locality, 27.iii.1992, R.B. Lachlan. *Holotype* in ANIC; *paratypes* in RBLC

Description. Male (Figs 25–26). Fore wing upperside as in Fig.25; black border at outer quarter of wing, narrowest and curving inwardly at tornus; one faint subapical white spot, sometimes with second indistinct spot; black costal border thickens distally at discocellulars with minor white suffusion at this point; hind wing upperside white with thin black border lunulate at inner edge. Fore wing underside as above with light yellow at costa in basal half of cell; black border a thin line at tornus; three subapical yellow spots with some white at distal edges; two small yellow dots at termen. Hind wing underside as in Fig.26; yellow proximal spot in white basal pear-shaped marking; black border with large triangular spots at end of veins between veins M_1 and CuA_2 , white submarginal spots pointed distally; thin black line at inner edge of red line, thicker than red between veins M_2 and CuA_1 ; large white discal pear-shaped area with yellow-orange patches at inner parts of cells, size of patches variable; thin red v-shaped line in cell at base of white pear-shaped discal patch. Length of fore wing: 24 mm.

Female (Figs 27–28). Fore wing upperside as in male but with broader black border, particularly at tornus. Hind wing upperside white with dark underside markings visible; broad black border widest at apex; inner edge suffused white with white spike-like projections almost to termen between veins, longest near apex. Fore wing underside similar to male, black border slightly less than above particularly at tornus, yellow in basal area of cell.



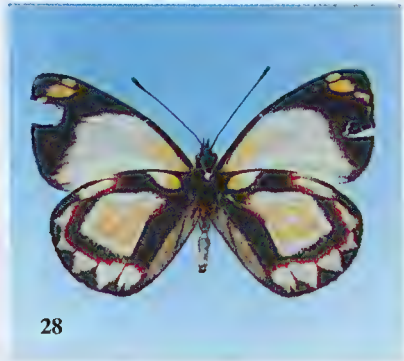
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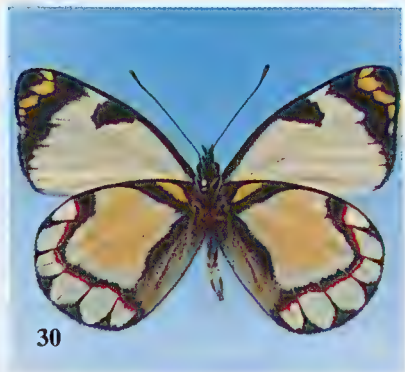
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Figs 25–30. (25–28) *Delias awongkor hindenburgensis* subsp. nov. (25) holotype male upperside; (26) holotype male underside; (27) female upperside; (28) female underside. (29–30) *Delias iltis bultemensis* subsp. nov. (29) holotype male upperside; (30) holotype male underside.

Hind wing underside similar to male; white submarginal spots reduced and very pointed between veins M_2 and CuA_2 ; thin red submarginal line as in male; black line proximad to red line very broad between veins M_1 and CuA_2 ; white pear-shaped discal patch reduced compared to male. Length of fore wing: 24 mm.

Etymology. *D. awongkor hindenburgensis* is named after the Hindenburg Range, the only known locality for the subspecies.

Discussion. The male of *D. awongkor hindenburgensis* was compared with the holotype of the nominate subspecies figured in the original description by van Mastrigt (1989) and the specimens figured by Yagishita *et al.* (1993). It differs by the broader black area at costa above cell, broader black margin on the fore wing upperside and the broader black lunulate border on the hind wing upperside. On the fore wing underside *D. awongkor hindenburgensis* differs also by the broader black costa above cell and broader black margin. On the hind wing underside the black border is thicker and triangular at the inner edge; the black line proximad of the thin red submarginal line is broader between veins M_2 and CuA_1 and the large white submarginal spots are more pointed distally. The female of *D. awongkor* van Mastrigt was previously unknown and that of *D. a. hindenburgensis* is illustrated here.

Yagishita *et al.* (1993), as a new combination, changed *D. flavistriga ilagaensis* van Mastrigt to *D. awongkor ilagaensis* van Mastrigt but as the text is in Japanese it is unclear why this was done, as the accompanying photograph of *D. a. ilagaensis* clearly shows a primary character of *D. flavistriga*, described by van Mastrigt (1989) in his key to (sub)species of the *Delias mesoblema* Jordan subgroup, the bright sulphur-yellow streak from near the base to anal angle in cell 3A. This is absent in *D. awongkor*. Also the specimens of *D. a. ilagaensis* figured by Yagishita *et al.* (1993) are noticeably larger, as are their basal spots on the underside of the hind wing, than the specimen shown of *D. a. awongkor*. The four male specimens of *D. a. hindenburgensis* are all smaller than specimens of *D. flavistriga* and *D. arabuana* Roepke examined and clearly concur with *D. a. awongkor* in size. I am inclined to agree with van Mastrigt (1996) that further studies are required before accepting doubtful new combinations. The types and large series from several localities should be examined, where possible, before making new combinations. This should include careful examination of the genitalia, particularly in closely related species groups.

***Delias iltis bultemensis* subsp. nov.**

(Figs 29–30)

Types. PAPUA NEW GUINEA: *Holotype* ♂, 16 km NE of Tabubil, 5°10'S 141°20'E, 2300m, 30.iii.1994, R.B. Lachlan. *Paratypes*: 6 ♂♂, same locality, 27.iii.1994, 18, 20.i.2000, R.B. Lachlan. *Holotype* in ANIC; *paratypes* in RBLC.

Description. Male (Figs 29–30). Fore wing upperside as in Fig.29; black border at vein M_3 at least 1 mm narrower than in nominate subspecies; hind wing white with narrow black terminal border. Fore wing underside as in nominate subspecies but with slightly narrower black border. Hind wing underside as in Fig.30; large pale creamy-yellow discal area, pinkish in some specimens, white distally at thin black and red submarginal lines; thin red line bordered by six large white spots, their rounded apices touching the termen; five black triangles at termen reduced; greenish-yellow anal margin suffused with white in most specimens; wide black line adjacent to greenish-yellow anal margin reduced to faint black scaling before reaching thin black submarginal line, this thin black submarginal line widest between veins M_1 and R_s but narrower than in nominate subspecies. Length of fore wing: 27–28 mm.

Female. Unknown.

Etymology. *D. iltis bultemensis* is named after the large village north of Tabubil whose people are the land owners of the area where this subspecies was collected.

Discussion. *D. iltis bultemensis* differs from both *D. iltis iltis* Ribbe and *D. i. leucotera* Talbot by the slightly narrower black border on the upperside and underside of the fore wing. On the hind wing underside there is a larger pale discal area with narrower black, and to a lesser extent red, submarginal lines. The six large white spots are larger and distinctly rounded at the termen and the five black triangular spots between the white spots are reduced. The greenish-yellow anal margin is suffused more heavily with white on most specimens and the wide black line adjacent to this area is reduced to faint black scaling before reaching the black submarginal line; this black line runs unbroken from the base to the submarginal black line in the other two subspecies. The submarginal black line is distinctly narrower between veins M_1 and R_s than in *D. i. iltis* and *D. i. leucotera*. *D. iltis bultemensis* appears to be generally smaller than the other subspecies. Parsons (1998) recorded *D. i. leucotera* as far west as Porgera in Enga Province. I have three specimens of this subspecies taken 25–30 km east of Tari, Southern Highland Province, about 45 km south-west of Porgera. *D. iltis* is a variable species (Parsons 1998) but the external characters described for *D. i. bultemensis* are consistent within the specimens examined and the population is 200 km west of the recorded localities for *D. i. leucotera*. It is interesting to note that *D. i. bultemensis* was only taken at one locality at 2300 m in the whole region that was surveyed.

Subspecies *D. i. majai* Yagishita was described from Irian Jaya but van Mastrigt (1996) noted that it undoubtedly belongs to *D. luctuosa* Jordan, probably the variable *D. luctuosa archboldi* Roepke. After examining the accompanying photographs in Yagishita *et al.* (1993) I am inclined to agree.

***Delias fascelis cartieri* subsp. nov.**

(Figs 31–34)

Types. PAPUA NEW GUINEA: *Holotype* ♂, 16 km NE of Tabubil, 5°10'S 141°20'E, 2300 m, 18.i.2000, R.B. Lachlan. *Paratypes:* 9 ♂♂, same locality, 30.iii.1994, 18-20.i.2000, R.B. Lachlan; 10 ♂♂, SE slopes of Mt Akrik (Ian), 15 km NW of Tabubil, Western Province, 5°10'S 141°09'E, 1625 m, 18.v.1991, 21.ix.1992, 20.xi.1993, 14, 18, 20.iii.1994, 3, 8, 10.iv.1994, R.B. Lachlan; 2 ♂♂, Mount Binnie, next to Ok Tedi mine, 2200 m, 5°13'S 141°08'E, 21, 27.i.2000, R.B. Lachlan; 1 ♀, same locality, 22.v.1993, R.B. Lachlan; 1 ♀, 16 km NE of Tabubil, 5°10'S 141°20'E, 2300 m, 3.iii.1994, R.B. Lachlan. Holotype in ANIC; paratypes in AMS and RBLC.



Figs 31–34. *Delias fascelis cartieri* subsp. nov. (31) holotype male upperside; (32) holotype male underside; (33) female upperside; (34) female underside.

Description. Male (Figs 31–32). Fore wing upperside with very broad black border entering distal half of cell; three or four small white subapical spots; basal area greyish-white. Hind wing upperside black border to end of cell, narrows sharply at M_2 then tapers to a point at tornus; four very small white dots at edge of termen in middle of cells between veins M_1 and CuA_2 . Fore wing underside black with light suffusion of white at inner margin and on middle of veins $1A+2A$ and CuA_2 ; three subapical spots and one or two subterminal spots, all yellow, thin yellow line from centre of lower spots to termen. Hind wing underside white median crenulate band narrow from costa to M_2 , then black to M_3 , below M_3 to tornus this median crenulate band creamy-yellow with bright yellow in cells; five thin yellow submarginal spots, tornal spot rounder; three small yellow spots at wing base, just below costa in cell R_s and inside discal cell; termen slightly scalloped. Length of fore wing: 23–26 mm.

Female (Figs 33–34). Fore wing upperside black area narrower at dorsum than male with heavy suffusion of black scales over entire cell as in nominate subspecies; three subapical spots, two smaller terminal spots, all creamy-yellow; cream discal patch below cell to inner margin suffused with grey basally. Hind wing upperside white with black border narrower than in male, tapering at tornus. Fore wing underside discal area creamy-white, mostly below vein CuA_2 , suffused black basally; discal cell black; three subapical spots, two terminal spots, all yellow and larger than upperside; postmedian costal spot faint or absent. Hind wing underside white crenulate median band continuous and slightly wider than in male, yellow markings below vein M_2 . Length of fore wing: 23–26 mm.

Etymology. Named in honour of the Parish Priest of the Catholic Parish of the Star Mountains, Father John Mark Cartier, who died suddenly on the 3rd January, 2000. Fr John selflessly served the local people of the Tabubil community and surrounding rural areas for many years.

Discussion. The male *D. f. cartieri* differs from *D. fascelis fascelis* Jordan on the upperside by the reduced basal grey-white area on the fore wing and broader black margin. On the hind wing upperside the white area is reduced with the black border reaching the distal end of the cell in almost every specimen examined. On the fore wing underside *D. f. cartieri* rarely has a yellow postmedian costal spot, the yellow subapical and terminal spots are more prominent and the light suffusion of white present in the discal area and on the veins is reduced.

The female differs from *D. f. fascelis* on the upperside by the reduced cream discal patch below the cell on the fore wing and larger black borders on both wings; on the fore wing underside the cell is completely black and the cream discal patch reduced with a broader black border. *D. f. cartieri* is only recorded from three localities in the Ok Tedi region between 1625 and 2300 m, some 140 km to the east of *D. f. fascelis*.

***D. luctuosa versicolor* subsp. nov.**

(Figs 35–40)

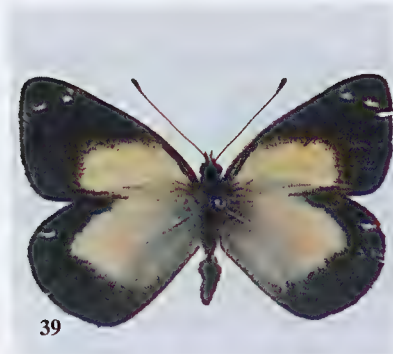
Types. PAPUA NEW GUINEA: *Holotype* ♂, Alpine grass area, 3200 m, 30 km NNW of Tabubil, 5°01'S 141°08'E, West Sepik Province, 18.xi.1991, R.B. Lachlan. *Paratypes*; 9 ♂♂, 3 ♀♀, same locality, 16–18.xi.1991, R.B. Lachlan. *Holotype* in ANIC; *paratypes* in RBLC.

Description. Male (Figs 35–38). Basal half of fore wing upperside white with broad black costal border entering distal third of cell; outer edge of white suffused with black; two or three small white subapical spots, one tiny terminal spot on some specimens. Hind wing upperside white with broad black terminal border; distal edge of white suffused with black, as in fore wing, undulate and with distinct white projections to termen in the middle of cells between veins M_1 and CuA_1 . Basal half of fore wing underside deep yellow to vein 1A+2A, slightly paler to dorsum; black bar at discal edge of cell usually connected to broad black border; two yellow post median spots suffused with black below costa, these are variable; three subapical spots, two terminal spots, all flattened and yellow-orange. Hind wing underside with cream discal patch suffused with pink centre, deep red basally in most specimens; black costal border connected to broad black anal border encloses a small pear-shaped deep yellow basal spot; broad black postdiscal band variable in thickness, on all paratypes examined thinner than in holotype; this band bordered on distal edge by thin red line; six thin white pointed subterminal triangles, five black terminal triangles with rounded apices on most specimens, more pointed on some specimens. Anal margin black with yellow suffusion. Length of fore wing: 28–30 mm.

Female (Figs 39–40). Fore wing upperside milky-white with broad black costal border filling distal third of cell, anterior half of cell suffused with black; broad outer border to inner margin curving basally along inner margin below vein 1A+2A; three small white subapical spots, one very small white terminal dot on some specimens. Hind wing upperside milky-white with broad black border from apex to tornus inner edge suffused with white, mostly at ternal area; 1–3 small white subterminal spots in cell spaces above M_1 to M_3 . Fore wing underside similar to male but the three yellow-orange subapical spots larger and outer black border wider at tornus. Hind wing underside as in male but with broader black curved postdiscal band in all specimens examined. Length of fore wing: 22–30 mm.

Etymology. The subspecific name is derived from 'versicolor', Latin for 'of various colors', and refers to the variety of colours on the underside.

Discussion. *D. l. versicolor* most closely resembles *D. l. kuning* van Mastrigt as both subspecies are yellow on the underside of the fore wing in both sexes. However, the male *D. l. versicolor* differs from *D. l. kuning* by having broader black margins and reduced white areas on the upperside of both fore and hind wings, on the fore wing underside



Figs 35–40. *Delias luctuosa versicolor* subsp. nov. (35) holotype male upperside; (36) holotype male underside; (37) male upperside; (38) male underside; (39) female upperside; (40) female underside.

the outer black border is wider and the slightly reduced yellow area reaches the inner margin; in *D. l. kuning* this is white. On the hind wing underside, the six white subterminal triangles are very narrow and pointed as in *D. l. archboldi* Roepke; as a consequence the five black terminal triangles are much rounder in most specimens than in *D. l. kuning*. As the female of *D. l. kuning* is unknown a comparison of females cannot be made. However *D. l. versicolor* differs from *D. l. luctuosa* Jordan by having reduced subapical spots on the fore wing underside, very thin sharp white subterminal triangles on the hind wing underside and also does not have the elongated hind wings seen in *D. l. archboldi* and *D. l. luctuosa*. *D. l. archboldi* does not have yellow on the fore wing. All specimens were collected at the type locality.

Additional records of *Delias*

The following species were recorded from the Ok Tedi region, Western Province or 30 km east of Tari, Southern Highlands Province. Specimens are in RBLC, with some duplicates held by ANIC and AMS.

Details of collecting sites are as follows:

Western Province

- (1) Mount Akrik (also known as Mt Ian), 5°10'S 141°09'E, 1625 m, creek surrounded by moss forest, 15 km NW of Tabubil.
- (2) Mount Binnie (behind Ok Tedi mine), 5°13'S 141°08'E, 2200 m, cleared ridge with moss forest.
- (3) Creek near alpine grass meadow, 5°10'S 141°20'E, 2300 m, surrounded by moss forest, 16 km NE of Tabubil.
- (4) Between Yuk Creek, 3 km north of Tabubil, and Tabubil, 5°15'S 141°13'E, 650-800 m, rainforest.
- (5) Ok Menga, 12 km SE of Tabubil, in creek surrounded by rainforest near power station, 5°20'S 141°18'E, 500 m.
- (6) Gulgubip airfield/village, 35 km east of Tabubil, wide tracks through rainforest, 5°17'S 141°31'E, 1400 m.
- (7) Ilam River, Tifalmin, 27 km NE of Tabubil, light forest cover at river edges, 5°07'S 141°25'E, 1300 m.
- (8) Kiunga, north Fly River, roads through lowland rainforest, 6°08'S 141°17'E, 60 m.

Southern Highlands Province

- (9) 30 km east of Tari, in creeks surrounded by moss forest, 5°58'S 143°07'E, 2100-2400 m.

List of species

Nomenclature is based on Parsons (1998). Numbers in parentheses indicate the actual collection site.

Delias aruna inferna Butler, 1871

(4) 3 ♂♂, 1 ♀; (9) 1 ♂. Uncommon. All five specimens match the photographs of *D. a. irma* Fruhstorfer, 1907, in Yagishita *et al.* (1993) but this was synonymised with *D. a. inferna* by Parsons (1998).

Delias mysis lara (Boisduval, 1836)

(4) 7 ♂♂, 4 ♀♀; (5) 7 ♂♂, 1 ♀. Uncommon.

Delias gabia zarate Grose-Smith, 1900

(4) 1 ♂; (5) 13 ♂♂; (6) 1 ♀. Uncommon.

Delias mavroneria mavroneria Fruhstorfer, 1914

(4) 10 ♂♂; (5) 4 ♂♂. Uncommon.

Delias ennia xelianthe Grose-Smith, 1900

(4) 6 ♂♂; (5) 2 ♂♂; (6) 1 ♀. Uncommon.

Delias geraldina geraldina Grose-Smith, 1894

(4) 15 ♂♂; (5) 3 ♂♂. Uncommon. Parsons (1998) stated that *D. g. geraldina* had been recorded between 220–1800 m. I never sighted it above 800 m and regard it as a low altitude species, at least in the Ok Tedi region.

Delias aroae (Ribbe, 1900)

(3) 22 ♂♂; (6) 1 ♂; (9) 4 ♂♂. Common locally.

Delias pheres Jordan, 1912

(1) 54 ♂♂; (2) 4 ♂♂, 3 ♀♀; (3) 31 ♂♂. Common. A new record for Papua New Guinea.

Delias flavissima Orr & Sibatani, 1985

(3) 5 ♂♂; (9) 16 ♂♂. Uncommon in Ok Tedi area. Common 30 km east of Tari.

Delias cuningputi (Ribbe, 1900)

(9) 1 ♀. Uncommon.

Delias oktanglap oktanglap van Mastrigt, 1990

(3) 9 ♂♂. A new record for Papua New Guinea.

Delias microsticha microsticha Rothschild, 1904

(1) 4 ♂♂; (3) 24 ♂♂, 2 ♀♀; (7) 2 ♂♂; (9) 3 ♂♂. Common in some localities but not in others.

Delias hagenensis Morinaka, van Mastrigt & Sibatani, 1993

(9) 2 ♂♂. Uncommon at this site.

Delias hallstromi Sanford & Bennett, 1955

(1) 2 ♂♂; (3) 1 ♂. An uncommon species. D'Abbrera (1978) stated its altitudinal range to be 7,000–12,000 ft (2135–3660 m). The two males from Mt Akrik were taken at only 1625 m.

Delias frater Jordan, 1911

(1) 2 ♂♂; (3) 45 ♂♂, 4 tt. Always very common at site (3). New record for Papua New Guinea.

Delias catisa catisa Jordan, 1912

(4) 7 ♂♂. Rarely encountered. Only taken along trail near creek in rainforest. A new record for Papua New Guinea.

Delias isocharis isocharis Rothschild & Jordan, 1907

(7) 1 ♀. Rare in the Ok Tedi region.

Delias ligata ligata Rothschild, 1904

(4) 1 ♂. Rare in the Ok Tedi region.

Delias alepa alepa Jordan, 1912

(1) 13 ♂; (2) 1 ♀; (3) 1 ♂. Uncommon generally. A new record for Papua New Guinea.

Delias iltis iltis Ribbe, 1900

(9) 3 ♂♂.

Delias luctuosa luctuosa Jordan, 1912

(9) 2 ♂♂.

Delias callista porquiaensis Yagishita, 1993

(1) 52 ♂♂, 4 ♀♀; (2) 22 ♂♂; (3) 15 ♂♂; (9) 3 ♂♂, 1 ♀. A very common species when encountered. Parsons (1998) described it as a rare subspecies known only from the holotype male and one other male specimen. This is perhaps the case in eastern Papua New Guinea. Most females collected have white on the upperside, several have yellow basal areas on the fore wings and one specimen has basal yellow fore wings with yellow on half the hind wings. Five of the males collected have strong yellow-orange markings replacing the normal yellow markings on the underside.

Delias hapalina amoena Roepke, 1955

(1) 7 ♂♂; (9) 5 ♂♂. Uncommon in the Ok Tedi region. More common in the Tari area.

Delias leucias leucias Jordan, 1912

(1) 30 ♂♂; 1 ♀; (3) 30 ♂♂. Parsons (1998) described *D. leucias* as rare generally but this subspecies was very common at both localities. Locality (3) is just 33 km west of Telefomin where *D. l. huonensis* Talbot was recorded by Parsons (1998). However, the specimens from locality (3) are definitely not *D. l. huonensis*. A new record for Papua New Guinea.

Delias leucias huonensis Talbot, 1928

(9) 18 ♂♂. A very common subspecies in the Tari area.

Delias niepelti Ribbe, 1900

(1) 60 ♂♂, 1 ♀♀; (2) 4 ♂♂; (3) 28 ♂♂, 4 ♀♀; (9) 5 ♂♂, 1 ♀. A very common species at all times of the year. Over the years hundreds were collected, examined and released. This is a very variable species, particularly where the hind wing underside white costal patch is concerned. At all localities specimens were taken with no patch, small patches, large patches as well as variations in other characters such as the yellow-orange basal region of the fore wing underside. Therefore the assigning of a subspecies name to the specimens taken at any of the localities is quite inappropriate.

Delias ladas ladas Grose-Smith, 1894

(1) 1 ♂; (4) 18 ♂♂; (5) 3 ♂♂; (6) 4 ♂♂. A very common subspecies at lower altitudes, 500–1625 m.

Delias eudiabolas Rothschild, 1915

(4) 3 ♂♂, 1 ♀; (6) 1 ♂. A rare species previously known by only 3 males and 2 females from the Aroa River region of eastern Papua New Guinea (Parsons 1998).

Delias wollastoni abmisibilensis van Mastrigt, 1990

(3) 2 ♂♂. Both specimens were taken flying across an open alpine grass meadow. A new record for Papua New Guinea.

Delias mira roepkei Sanford & Bennett, 1955

(9) 23 ♂♂. A common subspecies.

Delias clathrata clathrata Rothschild, 1904

(9) 1 ♂. Not common.

Delias nais nais Jordan, 1912

(1) 47 ♂♂, 7 ♀♀; (2) 3 ♀♀; (3) 1 ♂; (6) 1 ♂; (9) 2 ♂♂. A common subspecies.

Delias hypomelas hypomelas Rothschild & Jordan, 1907

(9) 1 ♂. Broader black margins on fore wing and hind wing upperside match specimens of *D. h. hypomelas* examined in the author's collection from Wau and Kerowagi areas.

Delias hypomelas conversa Jordan, 1911

(1) 46 ♂♂, 1 ♀; (2) 2 ♂♂; (3) 12 ♂♂, 3 ♀♀. Black borders of fore wing and hind wing upperside and small yellow subapical spots on fore wing underside reduced compared to *D. h. hypomelas*. A new record for Papua New Guinea.

Delias akrikensis Lachlan, 1999

(1) 6 ♂♂, 1 ♀. A rare species known only from the type locality.

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